Thomas J. Vitolo, Ph.D., Associate

Synapse Energy Economics I 485 Massachusetts Avenue, Suite 2 I Cambridge, MA 02139 I 617-453-7036
tvitolo@synapse-energy.com

PROFESSIONAL EXPERIENCE

Synapse Energy Economics Inc., Cambridge, MA. *Associate*, 2011 – present.

Performs consulting, conducts research, and assists in writing testimony and reports on a wide range of issues relating to electric utilities, energy efficiency, electricity transmission and generation, consumer advocacy, environmental policy and compliance, and air emissions.

Jointown Group Co., Ltd., Wuhan, China. *System Engineer Intern*, Summer 2007.

Developed and implemented a modified (*s*,*S*) inventory management scheme for over 20,000 warehoused pharmaceutical products, resulting in more orders filled, lower carrying costs, and a reduction in the frequency of product expiration.

MIT Lincoln Laboratory, Division 6, Group 65, Lexington, MA. *Research Assistant*, 2003 – 2006.

Designed algorithm and implemented software to create autonomous wireless point-to-point topologies for aerial, land-based, and nautical vehicles as part of an Optical & RF Combined Link Experiment (ORCLE) funded by Defense Advanced Research Projects Agency (DARPA).

EDUCATION

Boston University, Boston, MA
Doctor of Philosophy in System Engineering, 2011. Developed algorithms to discover degree constrained minimum spanning trees in sparsely connected graphs.

Dublin City University, Dublin, Ireland
Master of Science in Financial and Industrial Mathematics, 2001. Researched partial differential equations modeling fluid flow over an erodible bed.

North Carolina State University, Raleigh, North Carolina
Bachelor of Science in Applied Mathematics, 2000. *Summa Cum Laude*.
Bachelor of Science in Computer Science, 1999. *Summa Cum Laude*.
Bachelor of Science in Economics, 1998. *Summa Cum Laude*.

ADDITIONAL EXPERIENCE

TEACHING

- Graduate Teaching Fellow, Boston University College of Engineering. *Introduction to Engineering Computation*, 2009
- Guest Lecturer, Boston University Department of Systems Engineering, *Case Studies in Inventory Management*, 2007-2008
- Guest Lecturer, Boston University Department of Systems Engineering, Solving Linear Programs with CPLEX, 2003-2008

GOVERNMENT SERVICE

- *Constable*, Brookline, MA, 2010 – present
- *Town Meeting Member*, Brookline, MA, 2007 – present
- *Bicycle Advisory Committee Member*, Brookline, MA, 2007 – present.

OTHER INFORMATION

FELLOWSHIPS AND SCHOLARSHIPS

- National Science Foundation IGERT Fellowship, 2006 – 2008
- National Science Foundation GK-12 Fellowship, 2002 – 2003
- Mitchell Scholarship, 2000 – 2001
- Park Scholarship, 1996 – 2000

ADDITIONAL SKILLS

- Computer Applications: Microsoft Office, LaTeX
- Programming: Fortran, C, C++, perl, MATLAB, CPLEX

AFFILIATIONS

- Center for Computation Science, Boston University, 2006 – 2010
- Center for Information and Systems Engineering, Boston University, 2002 – 2010

PUBLICATIONS

Woolf, T., M. Whited, E. Malone, T. Vitolo, R. Hornby. 2014. *Benefit-Cost Analysis for Distributed Energy Resources: A Framework for Accounting for All Relevant Costs and Benefits.* Synapse Energy Economics for the Advanced Energy Economy Institute.

Vitolo, T., J. Fisher, K. Takahashi. 2014. *TVA's Use of Dispatchability Metrics in Its Scorecard.* Synapse Energy Economics for Sierra Club.

Vitolo, T., J. Daniel. 2013. *Improving the Analysis of the Martin Drake Power Plant: How HDR's Study of Alternatives Related to Martin Drake's Future Can Be Improved.* Synapse Energy Economics for Sierra Club.

Vitolo, T., P. Luckow, J. Daniel. 2013. *Comments Regarding the Missouri 2013 IRP Updates of KCP&L and GMO.* Synapse Energy Economics for Earthjustice.

Hornby, R., P. Chernick, D. White, J. Rosenkranz, R. Denhardt, E. A. Stanton, J. Gifford, B. Grace, M. Chang, P. Luckow, T. Vitolo, P. Knight, B Griffiths, B. Biewald. 2013. *Avoided Energy Supply Costs in New England: 2013 Report.* Synapse Energy Economics for the Avoided-Energy-Supply-Component (AESC) Study Group.

Stanton, E. A., T. Comings, K. Takahashi, P. Knight, T. Vitolo, E. Hausman. 2013. *Economic Impacts of the NRDC Carbon Standard.* Synapse Energy Economics for the Natural Resources Defense Council (NRDC).

Vitolo, T., G. Keith, B. Biewald, T. Comings, E. Hausman, P. Knight. 2013. *Meeting Load with a Resource Mix Beyond Business as Usual: A regional examination of the hourly system operations and reliability implications for the United States electric power system with coal phased out and high penetrations of efficiency and renewable generating resources.* Synapse Energy Economics for Civil Society Institute.

Stanton, E. A., F. Ackerman, T. Comings, P. Knight, T. Vitolo, E. Hausman. 2013. *Will LNG Exports Benefit the United States Economy?* Synapse Energy Economics for Sierra Club.

Ackerman, F., T. Vitolo, E. A. Stanton, G. Keith. 2013. *Not-so-smart ALEC: Inside the attacks on renewable energy*. Synapse Energy Economics for Civil Society Institute.

Woolf, T., M. Whited, T. Vitolo, K. Takahashi, D. White. 2012. *Indian Point Replacement Analysis: A Clean Energy Roadmap: A Proposal for Replacing the Nuclear Plant with Clean, Sustainable Energy Resources.* Synapse Energy Economics for Natural Resources Defence Council (NRDC).

Hornby, R., D. White, T. Vitolo, T. Comings, K. Takahashi. 2012. *Potential Impacts of a Renewable and Energy Efficiency Portfolio Standard in Kentucky*. Synapse Energy Economics for Mountain Association for Community Economic Development and Kentucky Sustainable Energy Alliance.

Keith, G., B. Biewald, E. Hausman., K. Takahashi, T. Vitolo, T. Comings, P. Knight. 2011. *Toward a Sustainable Future for the U.S. Power Sector: Beyond Business as Usual 2011*. Synapse Energy Economics for Civil Society Institute.

PRESENTATIONS AND POSTER SESSIONS

Vitolo, T. 2013. "How Big an Issue is Intermittency? Integrating Renewables into a Reliable, Low-Carbon Energy Grid," Presentation for Civil Society Institute webinar, April 17, 2013.

Vitolo, T. 2009. “RPS in the USA: The Present Impact and Future Possibilities of Renewable Portfolio Standards in America.” Presentation at Boston University Energy Club Seminar Series.

Vitolo, T. 2007. “An ILP Approach to Spanning Tree Problems on Incomplete Graphs with Heterogeneous Degree Constraints.” Presentation at INFORMS Annual Meeting.

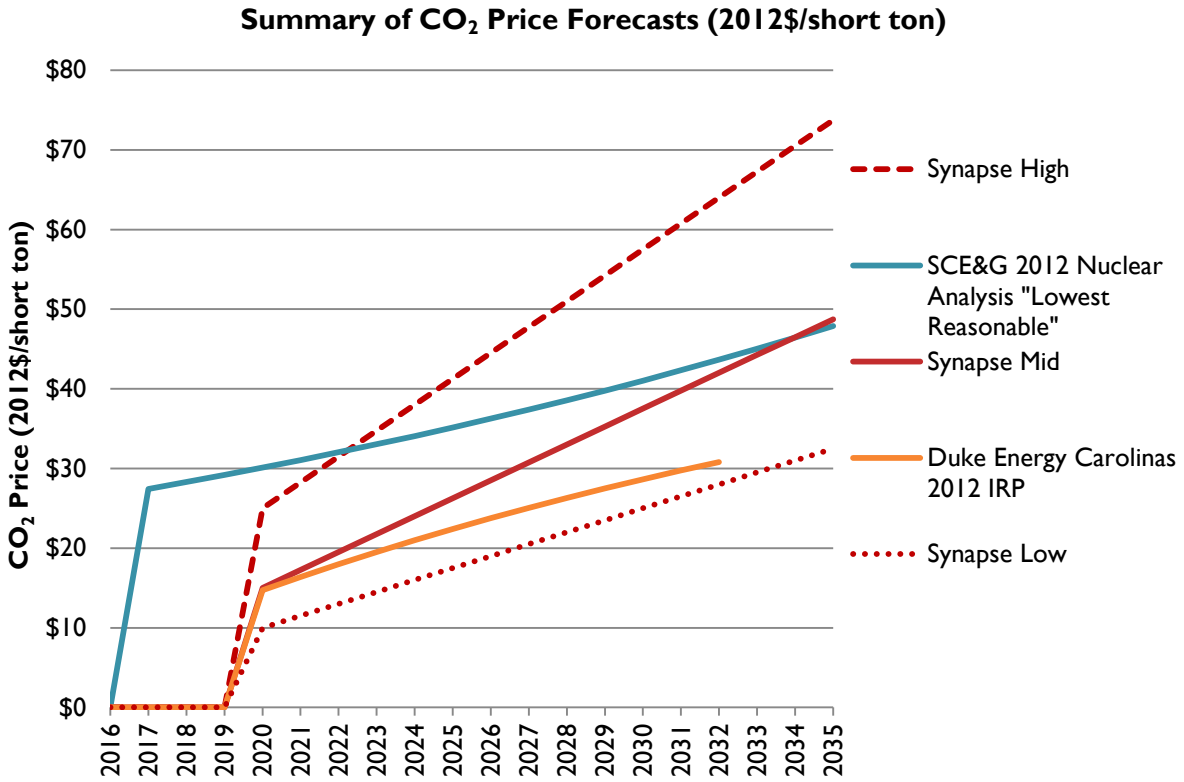
Vitolo T., J. Hu., L. Servi, V. Mehta. 2005. “Topology Formulation Algorithms for Wireless Networks with Reconfigurable Directional Links.” Proceedings of the IEEE Military Communications Conference, October 2005.

Vitolo, T. 2004. “Topology Design and Traffic Routing for Wireless Networks with Node-Based Topological Constraints.” Presentation at Boston University CISE Seminar Series.

TESTIMONY

Missouri Public Service Commission (Case No. EO-2011-0271): Rebuttal testimony Regarding Union Electric Company D/B/A Ameren Missouri. On behalf of the Missouri Office of Public Counsel. October 28, 2011.

Resume dated September 2014



Line	Year	Duke Energy Carolinas 2012 IRP	SCE&G 2012 Nuclear Analysis "Lowest Reasonable"	Synapse Low	Synapse Mid	Synapse High
1	2016	$0	$0	$0	$0	$0
2	2017	$0	$27	$0	$0	$0
3	2018	$0	$28	$0	$0	$0
4	2019	$0	$29	$0	$0	$0
5	2020	$15	$30	$10	$15	$25
6	2021	$16	$31	$12	$17	$28
7	2022	$18	$32	$13	$20	$32
8	2023	$20	$33	$15	$22	$35
9	2024	$21	$34	$16	$24	$38
10	2025	$22	$35	$18	$26	$41
11	2026	$24	$36	$19	$29	$45
12	2027	$25	$37	$21	$31	$48
13	2028	$26	$39	$22	$33	$51
14	2029	$28	$40	$24	$35	$54
15	2030	$29	$41	$25	$38	$58
16	2031	$30	$42	$27	$40	$61
17	2032	$31	$44	$28	$42	$64
18	2033	-	$45	$30	$44	$67
19	2034	-	$46	$31	$47	$71
20	2035	-	$48	$33	$49	$74

Duke for plotting purposes

$0
$0
$0
$0
$15
$16
$18
$20
$21
$22
$24
$25
$26
$28
$29
$30
$31
#N/A
#N/A
#N/A

Summary of Costs (Nominal $ / MWh)								
Line	Year	Coal	Natural Gas	EE (Utility Costs)	RE	EE/RE Blend	Block 2 CPP Shadow Price	Block 3&4 DER Total Value
1	2019	$35	$47	$71	$162	$116	--	--
2	2020	$35	$47	$73	$164	$118	$11	$118
3	2021	$36	$49	$75	$166	$121	$13	$121
4	2022	$37	$50	$77	$169	$123	$13	$123
5	2023	$38	$52	$79	$171	$125	$14	$125
6	2024	$40	$55	$81	$174	$127	$16	$127
7	2025	$41	$57	$82	$177	$129	$17	$129
8	2026	$42	$59	$84	$179	$132	$17	$132
9	2027	$43	$61	$85	$182	$134	$18	$134
10	2028	$44	$63	$87	$185	$136	$19	$136
11	2029	$45	$66	$88	$187	$138	$21	$138
12	2030	$46	$70	$90	$190	$140	$24	$140

Summary of Inputs				
Line	Input	Value	Unit	Source
13	**Heat Rate**			
14	Coal	10,300	*Btu/kWh*	Santee Cooper Comments and Appendices, Appendix D
15	Natural Gas	7,522	*Btu/kWh*	Santee Cooper Comments and Appendices, Appendix D
16	**Variable O&M**			
17	Coal	$4.40	*2011$/MWh*	Santee Cooper Comments and Appendices, Appendix D
18	Natural Gas	$3.20	*2011$/MWh*	Santee Cooper Comments and Appendices, Appendix D
19	EE Utility Percentage	75%		Santee Cooper Comments and Appendices, Appendix D
20	RE Cost	$145.57	*2012$/MWh*	Santee Cooper Comments and Appendices, Appendix D
21	**EE/RE Split**			
22	EE	50%		Santee Cooper Comments and Appendices, Appendix D
23	RE	50%		Santee Cooper Comments and Appendices, Appendix D
24	Escalation Rate	1.5%		Santee Cooper Comments and Appendices, Appendix D

Note that variable O&M costs are provided in 2011$ and RE costs are provided in 2012$. Based on the text within Appendix D, escalation rate is assumed to incorporate both real escalation and inflation.

SOUTHERN ENVIRONMENTAL LAW CENTER

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December 23, 2014

Public Service Commission of South Carolina
101 Executive Center Dr., Suite 100
Columbia, SC 29210

VIA ELECTRONIC FILING AS TESTIMONY EXHIBIT

RE: Petition of the Office of Regulatory Staff to Establish Generic Proceeding Pursuant to the Distributed Energy Resource Program Act, No. 236 of 2014, Ratification No. 241, Senate Bill No. 1189
Docket No. 2014-246-E

Dear Commissioners:

Over the past several months, the South Carolina Coastal Conservation League (CCL) and Southern Alliance for Clean Energy (SACE) have worked diligently with the Office of Regulatory Staff, the electrical utilities, and other intervenors in this generic proceeding to reach an agreement on a net metering methodology and net metering policy pursuant to Act 236. CCL and SACE support the Settlement Agreement filed by the Office of Regulatory Staff (ORS) on December 11, 2014. As set forth in greater detail in the Introduction and Preamble of the Settlement Agreement, SACE and CCL believe that the agreement is consistent with both the spirit and the letter of Act 236, and the groups believe that the Settlement Agreement is reasonable and serves as a practical means to bridge differences between the parties.

Because the Commission has not yet approved the Settlement Agreement, SACE and CCL filed on December 11, 2014 the *Direct Testimony of Thomas Vitolo, PhD* and the *Direct Testimony of John D. Wilson* in the above-referenced docket for consideration if the Commission does not approve the Settlement Agreement as filed by ORS. To the extent any of the testimony as originally filed or as amended conflicts with the terms of the Settlement Agreement, those portions of the testimony should be considered only if the Commission does not approve the settlement. SACE and CCL believe the Settlement Agreement is reasonable and should be approved by the Commission.

Thank you and please contact me if you have further questions.

Sincerely,

s/ J. Blanding Holman, IV
Attorney for Intervenors CCL and SACE

Cc: Parties of Record